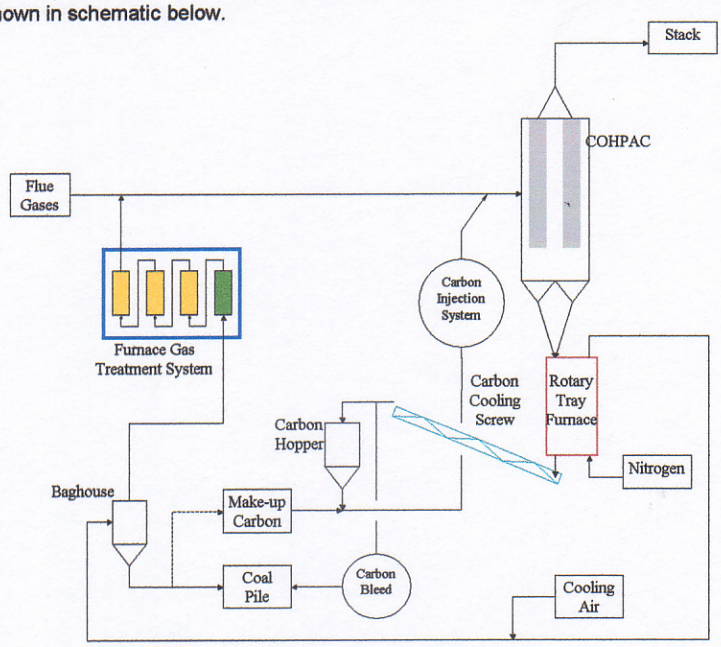
Pittsburgh Mineral & Environmental Technology, Inc.

Processing and Reuse of Activated Carbon Used to Adsorb Mercury from Power Plant Flue Gases

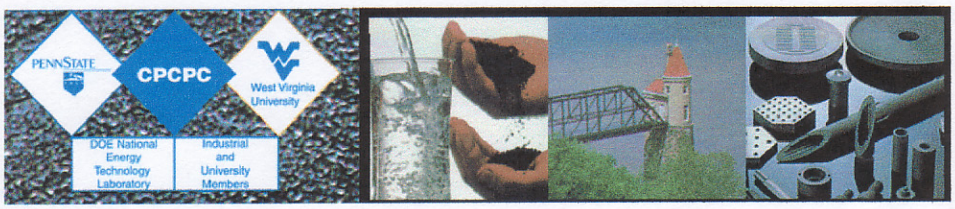
This project addresses the removal and recovery of mercury that is adsorbed on Powdered Activated Carbon (PAC) to remove mercury from coal combustion power plant flue gas streams. Previous work performed by ADA-ES and others for the US DOE has demonstrated the effectiveness of injecting PAC into flue gas streams for mercury removal. This approach has been highly successful in removing up to 80% of the mercury from the flue gas when the PAC is injected ahead of a COHPAC facility. To date, the PAC with sorbed mercury is assumed to be disposed after use. This will result in a significant expense for the mercury removal, since the most effective PAC employed to date is DARCO FGD manufactured by NORIT Americas which is estimated to cost approximately $0.50/ pound delivered to the power plant. In addition to the purchase expense, the disposal of this material may potentially fall under regulations requiring its disposal in "special" or hazardous waste landfills.

The proposed approach dramatically reduces the need for ongoing PAC purchases and provides for a thousand fold concentration of mercury in a specially formulated carbon that can subsequently be treated for mercury recovery as a salable metal, thus avoiding any disposal of potentially toxic waste streams. The estimated operating cost for this process is ~$0.05/lb of treated PAC compared with a purchase price of $0.50/lb PAC and an unknown but potentially significant disposal cost. The anticipated process is shown in schematic below.



PAC is injected into the flue gas stream ahead of the COHPAC bag filter. Mercury contained in the flue gas is removed from the gas stream as gas passes thru the carbon layer on the COHPAC bags and exits the facility via the plant stack. PAC in the COHPAC is periodically removed from the filter bags and fed to a rotary tray furnace for mercury removal from the PAC. This furnace is sealed and operates under an inert counter flowing nitrogen atmosphere. Mercury vapor exits the rotary tray furnace with the nitrogen process gas and is directed to a multiple column gas treatment system which utilizes packed beds of sulfur impregnated carbon to remove the gaseous mercury from the cooled process gas stream. After passing thru the sulfur impregnated carbon columns, the carrier gas is injected into the flue gas stream ahead of the carbon injection site.

Carbon exits from the rotary tray furnace via an air lock to a water-cooled screw conveyor. The cooled carbon is returned to the carbon hopper supplying the PAC injection system. Depending upon the amount of ash recovered in the COHPAC, a bleed stream of carbon will be required to maintain a material balance in the system. The bleed stream will take a portion of the desorbed carbon from the screw discharge. This material can be combusted in the coal-fired boiler.



Project Objectives

- Define the process variables required to achieve desorption of the PAC carbon which will define the size and capacity for the desorber unit.
- Characterize the mercury-laden PAC to determine the amount of ash collected in the COHPAC filter.
- Determine the ability of the PAC to be desorbed and reused without significantly reducing the carbon activity.

Cost Comparison for Mercury Removal with Carbon Disposal and Desorption

A METSIM (computer based mass and energy balance software that incorporates chemical thermodynamics) model for the proposed desorption process has been prepared to develop the cost projections shown.

Operating Costs (per lb of injected carbon)	COHPAC with ADA Injection System	COHPAC with ADA Injection System and Hg Desorption Process
Capital Cost (less COHPAC)	$500,000 $0.33[1]	$750,000 $0.49[1]
Carbon Cost	$0.50	-----
Energy Cost	-----[2]	$0.01
Labor Cost	$0.02[3]	$0.02
Reagent Cost	-----	$0.01[4]
Total Operating Costs	**$0.85**	**$0.53**

1) 3 year amortization at 6.0% APR.
2) Was not reported in ADA paper.
3) Assumed to be 2 hours per day.
4) HGR Carbon plus Hg Treatment Cost

PMET's leadership position in the processing of mercury-contaminated materials results from its exclusive use of its patented Mercury Removal/Recovery Process, a medium-temperature thermal process that has been proven on a commercial scale to reduce mercury to insignificant levels and recover 99% pure metallic mercury for reuse. This technology has been:

- Designated Best Demonstrated Available Technology (BDAT) by the U.S. Environmental Protection Agency.
- Awarded the prestigious R&D 100 Award by R&D Magazine
- Awarded the Three Rivers Environmental Excellence Award
- Named in a special Forbes Magazine supplement as "one of the 25 top new environmental technologies"

MRS℠